

S P E C I F I C A T I O N

Method and apparatus for printing coded marks on identification plates for cables and electrical equipment

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5 FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to a method for printing coded marks on identification plates for cables and electrical equipment.

10 The invention further relates to an apparatus for implementing the aforementioned method.

In the realization of electrical systems, particularly in buildings or on industrial machinery, the technique is known of associating to electrical cables, as well as to electrical equipment such as switches, 15 remote switches, terminals and the like, appropriate coded marks that allow easily to identify the wiring to facilitate subsequent checking operations and/or new wiring, for instance when conducting maintenance and/or repairs.

20 In many cases, such marks or identification codes are shown on small plastic tags which are engaged to the cables or the electrical equipment by means of containment sheaths made of transparent material and/or by means of other kinds of latching or engagement 25 elements.

The tags are normally realized by means of an injection molding phase. More specifically, with a single injection molding phase at least one card is produced with substantially planar conformation, comprising at 30 least a molding blank whereto, by means of frangible portions, is attached a plurality of plates suitable to be individually detached, as needed, by breaking the respective frangible portion.

35 The coded marks are written on the plates at a subsequent time, by means of a plotter essentially comprising at least a nib movable on two orthogonal axes

above a table whereon the card is positioned. The operation of the plotter is controlled by an electronic computer wherein the working program for writing the coded marks on the individual plates is stored.

5 For more than two decades. i.e. since the methods for writing coded marks with the aid of the plotter have been marketed, great efforts have been made to seek to improve the efficiency of the plotter, particularly in terms of writing speed and working precision. To provide
10 an indication of the results attained so far, it is noted that printing six character alphanumeric codes on a card containing 59 plates sized 4 x 15 mm is completed in the order of 6 minutes.

In this circumstance, within the scope of the
15 realization of the plates specified above, the use of plotters has always been deemed satisfactory and indispensable for writing the codes in an automated, versatile, sufficiently fast and precise manner.

All this stated, the Applicant has tackled the
20 problem of applying to the plates also chromatic marks, e.g. comprising alphanumeric characters on a colored background with one or more colors, and/or bar codes currently exceeding the capabilities of plotters. Hence it has been observed that by replacing writing methods by
25 plotter with hot ink transfer or sublimation printing methods, the problem described above can be solved, obtaining a surprising increase in versatility and flexibility in the type or marks that can be placed on the plates.

30 It has further been noted that the times required to place the coded marks on the plates can be drastically reduced, to values which so far had been unthinkable if, instead to the conventional method of writing with the aid of a plotter, a printing method by hot ink transfer
35 or sublimation is adopted.

Moreover, it has been found that the methods of

printing by means of hot ink transfer or sublimation on the plates of the kind specified above, can unexpectedly be realized using peripheral printing units already present on the market, though employed for purposes and
5 in sectors that are completely different from the one whereto the present invention is aimed, without necessarily requiring extensive modifications and/or the realization of peripheral units specifically designed and built for the realization of said identification plates.

10 SUMMARY OF THE INVENTION

In particular, the subject of the present invention is a method for printing coded marks on identification plates for cables and electrical equipment, said plates being mutually connected by means of frangible portions
15 to form a substantially planar card, presenting a surface to be printed opposite to a base surface, characterized in that it comprises the following phases: approaching to the surface to be printed of said card a ribbon shaped support bearing at least a layer of ink; heating the
20 ribbon shaped support and the plate on at least one portion of the respective mutually approached surfaces to determine a transfer of the ink from the ribbon to the plate.

Yet another subject of the present invention is an
25 apparatus for printing coded marks on identification plates for cables and electrical equipment, said plates being mutually connected by means of frangible portions to form a substantially planar card, presenting a surface to be printed opposite to a base surface, characterized
30 in that it comprises: first means for positioning said card; second positioning means operating on a ribbon shaped support bearing at least a layer of ink on at least one of its surfaces to place the ribbon shaped support in an approached relationship to the surface to
35 be printed of the card; a heating unit able to operate on the mutually approached surfaces of the ribbon shaped

support and of the card to determine a transfer of the ink from the ribbon shaped support to the card.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the invention shall be made more readily apparent from the content of the detailed description of some preferred, but not exclusive, embodiment of an apparatus for printing coded marks on identification plates for cables and electrical equipment, according to the present invention.

The description shall be made below with reference to the accompanying drawings, provided purely by way of non limiting indication, wherein:

- Figure 1 shows a perspective view of a peripheral printing unit usable to realize the printing method in accordance with the present invention;

- Figure 2 schematically shows a longitudinal section of the peripheral printing unit highlighting the path followed by the card for purposes of reproducing coded marks on its printable surface;

- Figure 3 shows a plan view of a card bearing a plurality of plates to be printed by means of the method according to the invention;

- Figure 4 shows a plan view of a further embodiment of a card bearing a plurality of plates to be printed by means of the method according to the invention;

- Figure 5 shows a cross section view of a card engaged to a support template usable for purposes of executing the printing process;

- Figure 6 shows a cross section of a further embodiment of a card engaged to a support template;

- Figure 7 schematically shows a calendering unit for the hot transfer of coded marks on the card bearing the plates, in accordance with a second embodiment of the apparatus according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the mentioned figures, the number

1 indicates in its entirety an apparatus for printing coded marks on identification plates of cables and electrical equipment, according to the present invention.

5 The plates 2 destined to be treated by means of the apparatus 1 are preferably made of rigid or semi-rigid material, with hardness preferably no lower than 40 Shore D, for instance polycarbonate, PVC, or polyamide, injection molded. The plates 2 are mutually connected to form, altogether, a card 3 of substantially quadrangular planar shape. More specifically, the plates 2 are joined to one or more molding blanks 4, each by means of one or more frangible portions 2a, 2b which allow their easy detachment at the moment when, in a way known in itself, the individual plates are to be applied to respective
10 cables and/or electrical equipment.

As shown in Figures 3 and 4, the card 3 can also be provided with one or more pre-breaking notches 4a to allow the mutual separation of the blanks 4 with respective plates 2 thereby facilitating their
20 employment. Alternatively to injection molding, the card 3 with the plates 2 can be obtained by means of a carving operation by die cutting, milling blanking or with laser beam, performed on a planar sheet of plastic or plastic-coated material, obtained for instance by calendering.

25 In accordance with a preferential embodiment, shown in Figure 3, each plate 2 is connected at respectively opposite parts to two blanks 4, respectively by means of a primary frangible portion 2a and an auxiliary frangible portion 2b. Fastening each plate 2 by means of both its
30 extremities to the card 3 ensures the positioning stability of the plate itself during the subsequent printing phase of the coded marks. The auxiliary frangible portions 2b present smaller dimensions than the primary frangible portions 2a and follow one another in
35 alternating sequence with respect thereto. In this way, after the mutual detachment of two adjacent blanks 4 only

the secondary frangible portions 2b will break, and to each of the blanks 4 will remain fastened only the plates 2 connected thereto by means of the primary frangible portion 2a, set in alternating sequence with respect to the plates belonging to the other blank.

All this having been stated, the card 3 essentially presents a base surface 3a which can be substantially planar (Figure 6) or provided with engagement projections 5 (Figure 5) able to allow to facilitate the connection of the single plates 2 to the respective cables and/or electrical equipment.

To the side opposite the base surface 3a, the card 3 presents a substantially planar surface to be printed 3b, in correspondence with which can be printed the identification codes on the individual plates 2.

In accordance with the present invention, printing the identification codes on the card 2 essentially entails approaching to the surface to be printed 3b of the card 3 at least a ribbon shaped support 6 on at least one surface thereof, preferably oriented towards the surface to be printed 3b, is transferred at least a layer of ink substantially composed of pigments mixed in appropriate waxes or resins. The ink, or at least the pigments contained therein, are stably joined to the ribbon shaped support 6 at ambient temperature, or in any case at temperatures indicatively below 70-80°C.

The ribbon shaped support 6 and the plates 2 mutually approached are then subjected to a heating phase whereupon the ink, or at least its pigments, separate from the ribbon shaped support and are transferred on the plates 2 which, at least in correspondence with the surface to be printed 3a, in the meantime have reached such a temperature as to favor the intimate union of the pigments between the molecules that make up the plastic material constituting the plates themselves.

For example, with plates 2 made of PVC the phase

whereby the ink is transferred by heat, described above, can take place at a temperature indicatively ranging between 100 and 250°C.

In accordance with a preferential embodiment of the invention, the subject method is suitable to be implemented by means of a peripheral printing unit, indicated in its entirety with the number 7 in Figure 1, and more in detail a printing unit that operates by hot ink transfer and/or sublimation of the type usable to print graphic designs on credit cards and/or similar magnetic cards.

In this circumstance, it may be advantageously provided for the card 3 to present the same shape and equal, or at least no smaller, dimensions than those of a conventional credit card.

The peripheral printing unit 7 essentially comprises first and second positioning means 8, 9 set to act respectively on the card 3 and on the ribbon shaped support 6 to position them in mutually approached relation, as described above. More specifically, the first positioning means 8 preferably comprise first motor driven rollers 10 set to act on the individual cards 3 to make them advance individually along sliding guides 11 provided in the peripheral printing unit 7. A feeding assembly 12 can be provided in proximity to an inlet end 11a of the sliding guide 11 to thrust constantly upwards a stack of cards 3 to be printed, thereby assuring its contact with an auxiliary feeding roller 12a.

The second positioning means 9 in turn comprise at least a motor driven collection drum 13 able to be actuated in rotation to wind the ribbon shaped support 6, made in the form of continuous ribbon coming from a feeding drum 14. After the actuation in rotation of the collection drum 13, the ribbon shaped support 6 is driven longitudinally over a series of idle transmission rollers 15 which guide it according to a pre-determined path

passing underneath a print head 16. Underneath the print head, the ribbon shaped support 6 acts in contact relationship against the surface to be printed 3a of the card 3. A certain contact pressure between the ribbon 6 and the card 3 is guaranteed by an elastic pre-load transmitted to the print head 16.

The print head 16 acts as a pre-heating unit set to interact on punctiform portions of the mutually approached surfaces of the ribbon shaped support 6 and of the card 3. In this way, the transfer of the ink, distributed in the form of a uniform layer over the entire surface of the ribbon shaped support 6, takes place according to the punctiform portions subjected to heating by the print head 16. The entire operation of the peripheral printing unit 7 is controlled by an electronic computer (not shown herein), such as a personal computer, according to a stored program containing all the data of the coded marks to be printed on the individual plates 2, in such a way as to reproduce the marks of each individual plate by means of a sequence of mutually juxtaposed points, each corresponding to one of the punctiform portions wherein the localized heating of the surfaces of the ribbon 6 and of the card 3 is determined.

In addition to the use of monochromatic inked ribbons, the ribbon shaped support 6 can advantageously present, on its longitudinal development, two or more superficial portions bearing respectively different inks, in order to obtain any color during the printing phase. More in detail, along the ribbon shaped support 6 can be provided a series of segments each comprising a sequence of five longitudinally consecutive superficial portions, that is to say three portions respectively bearing inks of three different colors, i.e. cyan, magenta and yellow, as well as a portion with black ink and a portion with clear scratch-proof protective ink. When executing the printing process for a single card 3, the phases of

approaching the ribbon and heating according to punctiform portions are sequentially repeated involving, on each occasion, the superficial portion of the ribbon bearing the ink of a pre-determined color, situated underneath the print head 16 and moved together with the card 3 upon the action of the second positioning means 9 operating in synchrony with the first positioning means 8.

More in particular, each superficial portion of the ribbon 6, bearing the respective type of ink, preferably presents a longitudinal extension that is substantially equal to the dimension measurable on the card 3 in the direction of advance along the sliding guides 11, so that the printing operation executed on this portion of the ribbon shaped support 6 can involve the whole extension of the printable surface 3b of the card itself. Once the print of a color is complete, the motor driven rollers 10 take the card 3 with its front end in proximity to the print head 16, to start printing the following color, also provided in correspondence with the print head 16 by means of the second positioning means 9.

Thus it is possible to print, on the individual plates 2, any type of coded mark, be it alphanumeric, chromatic or with bar codes.

Advantageously, on the card 3, and in particular in correspondence with the blanks 4, a free area "S" can be provided, suitable for receiving auxiliary graphic designs, comprising for instance the mark of the company supplying the cards and/or additional coded marks. The reproduction of such auxiliary graphic designs and/or coded marks can be effected by the same peripheral printing unit 7, while at the same time printing the coded marks on the individual plates 2.

In correspondence with the free area "S" can also be provided at least a bar code, or a magnetic insert, or a hologram or other type of identifying seal 17, able to be

associated to the card 3 simultaneously with or immediately after the injection molding phase whereby the card itself is realized. This seal 17 can be identified by suitable sensor means 17a, not described herein as they are obtainable in a manner known in itself, associated to the peripheral printing unit 7 and operating, for instance, along sliding guides 11 or anyway positioned in a manner suitable for recognizing the presence of the seal on the card 3. The sensor means 17a function in such a way as to enable the operation of the print head 16 and, hence, the execution of the heating phase described above, as well as the operation of the positioning means 8, 9, only upon the detection of the identifying seal 17 on the card itself. This allows to avoid printing identification marks on unauthorized cards.

Alternatively, the identifying seal 17 can be associated to a package containing a predetermined number of cards, or to the first card in a card lot. In this case, the sensor means 17a associated with the peripheral printing unit 7 can enable, upon identification of the aforementioned seal, the operation of the print head 16 for a number of work cycles equal to the number of cards contained in the lot or in the package whereto the seal is associated.

Before the execution of the printing operation, the card can advantageously be subjected to a preliminary phase wherein it is coupled with a support template 18 (Figures 5 and 6) presenting a coupling side 18a oriented towards the base surface 3a of the card itself, and a substantially planar base side 18b, oriented opposite to the coupling side 18a.

As shown in Figure 5, at least on the coupling side 18a can be obtained appropriate seats 19 for housing possible engagement projections 5 provided on the base surface 3a of the card 3. In this situation, the use of

the support template 18 allows to prevent the presence of the engagement projections 5 from requiring the provision of suitable grooves along the sliding guides 11 and/or on the motor driven rollers 10 dedicated to moving the card 3 within the peripheral printing unit 7. Moreover, support templates 18 can be realized that are suitable to house cards 3 equipped with different types of engagement projections 5, thereby allowing to treat any kind of card 3 without requiring a modification on the peripheral printing unit 7.

The support template 18 can also present a peripheral edge 18c that projects with respect to the coupling side 18a according to a height equal to or slightly smaller than the thickness of the card 3. The peripheral edge 18c is suited to act against the peripheral edges of the card 3 to ensure its stable positioning with respect to the support template. In addition or alternatively to the peripheral edge 17c, ribs 18d can be provided, projecting from the coupling side 18a to be interposed between respectively adjacent plates 2 and thereby fix the positioning of the card 3 on the template 18.

The dimensions of the support template 18, particularly in relation to its own thickness measured between the coupling side 18a and the base side 18b, are such that the sum of the thickness of the support template itself and of the card 3 is substantially equal, or anyway not greater than, the dimension of a clearance "L" defined in the peripheral printing unit 7, and more specifically between the sliding guides 11 and the motor driven rollers 10, to allow the passage of the card.

Also when using a card 3 having planar base surface 3a, i.e. lacking engagement projections 5, a support template 18 can be employed to obtain an overall thickness that is equal to the dimension of the clearance.

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In accordance with another possible embodiment of the invention, the ribbon shaped support 6, realized in the manner of a sheet (7) or continuous form, is inked by means of a peripheral print unit (not shown) for instance
5 of the ink jet, laser, or other kind, in such a way as to reproduce on the ribbon shaped support itself the coded marks to be printed on the plates 2. Inking the ribbon shaped support can entail the use of two or more different types of ink to obtain alphanumeric and/or
10 chromatic and/or bar code marks of any kind, as well as possible reproductions of graphic designs and/or marks on the free areas "S" provided in the cards 3.

The inked ribbon shaped support, which can present dimensions corresponding to those of one or more cards 3
15 coplanarly positioned one next to the other, is superimposed to the surfaces to be printed 3b of the cards 3, then effecting the heating phase necessary to transfer the ink, or its pigments, from the ribbon shaped support to the cards themselves. In this embodiment, the
20 heating phase is effected simultaneously and homogeneously over the entire transverse and/or longitudinal extension of the mutually approached surfaces of the ribbon shaped support 6 and of said one or more cards 3.

25 In accordance with said embodiment, the first positioning means can comprise at least one support template 18 for one or more cards 3, similar to the one described above with reference to Figures 5 and 6, whilst the second positioning means 9 can for instance comprise
30 a frame (not shown) for the engagement of the ribbon shaped support which can be coupled to the support template 18 in such a way as to ensure the correct mutual positioning between the ribbon shaped support and the cards 3. Alternatively, the ribbon shaped support 6 can
35 be positioned manually, exploiting the visual reference provided by the presence of the marks printed on the

ribbon shaped support itself.

The thermal transfer of the ink can be accomplished with the aid of a heating unit comprising for instance a calendering unit 20 having one or more opposite rollers 21, heated by electrical resistors and able to be actuated in rotation, between which the ribbon shaped support 6 coupled to the card 3 is made to pass as described above.

Alternatively, the calendering unit 20 can be replaced by a plate heated by electrical resistors and movable towards the card or cards 3, to thrust against them the inked ribbon shaped support 6.

The present invention attains important advantages.

As described above, the print operation effected by means of hot ink transfer allows to print not only alphanumeric, but also chromatic coded marks on the plates.

The high printing quality, particularly in terms of definition, also allows to print complex codes, for instance bar codes.

It is also possible to print alphanumeric and/or bar codes superimposed on chromatic codes.

The increase in operational versatility brought on by the method and the apparatus in accordance with the present invention is thus readily apparent; it is also paired with an unexpected increase in the operating versatility of the identification plates of the kind whereto the present invention is specifically aimed.

The invention further allows to reduce the time required to print the coded marks on the plates, down to values that were unthinkable in the prior art. It should be noted that when using an ink sublimation peripheral printing unit the time required to complete the monochromatic print of one card, containing for instance 21 cards, is about 5-8 seconds. Advantageously, this printing time is also substantially unchanged even after

an increase in the number of plates, of smaller size, provided in the individual card, and/or after an increase in the number of alphanumeric characters and/or of chromatic codes to be printed on individual plates.

5 The fact should be stressed that execution of the printing operation in such limited times was unthinkable in the prior art which, employing plotters, required at least 2-3 minutes to execute the same kind of work process.

10 The invention also enables to print on the cards graphic designs such as marks or other indications independent from the coded marks printed on the plates, without thereby entailing any increase in work cycle times.

15 Yet another advantage attained by the invention consists of a greater reliability in the execution of the printing operation which, with conventional plotters, was prone to frequent interruptions due to malfunctions in the nibs used in plotters. These malfunctions were also
20 due to the need to use particular inks with highly volatile solvents in order to guarantee the indelibility of the markings.